

## Integrated Rate Law Review and Half Life

1. Match the correct equation with the reaction order by writing zero, first, or second in each blank.

$\frac{1}{[A]_t} - \frac{1}{[A]_0} = kt$	_____	$t_{1/2} = \frac{[A]_0}{2k}$	_____
$[A]_t - [A]_0 = -kt$	_____	$t_{1/2} = \frac{1}{k[A]_0}$	_____
$\ln[A]_t - \ln[A]_0 = -kt$	_____	$t_{1/2} = \frac{0.693}{k}$	_____

2. Write the first order integrated rate law in its “division” form.

3. Rearrange the integrated rate laws into equations for a line:  $y = mx + b$ .  
For each reaction order, identify what type of plot (y vs x) will give a straight line, and identify what the slope of the resulting line corresponds to.

	y	vs	x	slope
zero				
first				
second				

4. Identify whether each of the following statements about half-lives refers to zero, first, and/or second order reactions.

\_\_\_\_\_  $t_{1/2}$  is constant during a rxn.

\_\_\_\_\_  $t_{1/2}$  varies during a rxn, getting longer as the rxn proceeds.

\_\_\_\_\_  $t_{1/2}$  varies during a rxn, getting shorter as the rxn proceeds.

\_\_\_\_\_ For a given rxn, two scientists will get different  $t_{1/2}$  values experimentally if they use different initial concentrations.

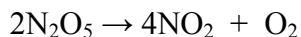
\_\_\_\_\_ For a given rxn, two scientists will get the same  $t_{1/2}$  value experimentally, regardless of initial concentration.

5. Which of the following data sets corresponds to a second order reaction?

<u>A</u>			<u>B</u>			<u>C</u>	
[A](M)	t(s)		[A](M)	t(s)		[A](M)	t(s)
100	0		100	0		100	0
50	10		50	10		50	10
25	20		25	30		25	15

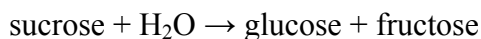
6. It takes 30.0 min for the concentration of a reactant in a second order reaction to drop from 0.40 M to 0.30 M.  
a) What is the value of the rate constant for this reaction and its units?  
b) How long will it take for the concentration to drop from 0.40 M to 0.20 M?

7. For the first order reaction:



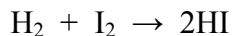
- a) If 20.0% of the initial  $\text{N}_2\text{O}_5$  decomposes in 2.10 hr, what is the rate constant?  
b) What is the half-life of the reaction?  
c) If the initial concentration of  $\text{N}_2\text{O}_5$  was 0.222 M, what concentration remains after 24 hr?

8. Hydrolysis of sucrose yields the simple sugars glucose and fructose:



The rate follows the rate equation:  $\text{Rate} = k[\text{sucrose}]$  and has a half-life of  $3.3 \times 10^5$  s.  
If the initial concentration of sucrose is 0.10 M, what will be the concentration of sucrose after 24 hours?

9. Consider the reaction of hydrogen with iodine:



This reaction has rate constants of  $1.41 \times 10^{-5} \text{ M}^{-1}\text{s}^{-1}$  at  $393^\circ\text{C}$  and  $1.40 \times 10^{-4} \text{ M}^{-1}\text{s}^{-1}$  at  $443^\circ\text{C}$ .  
What is the activation energy for this reaction?